U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB-286 272

Lawne Lake
Orange County, Florida

(U.S.) National Eutrophication Survey, Corvallis, OR

Prepared for

Corvallis Environmental Research Lab, OR

Dec 77

PB 286 272

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

G.P.O. 699-440

REPORT

ON

LAWNE LAKE

ORANGE COUNTY

FLORIDA

EPA REGION IV

WORKING PAPER No. 262

WITH THE COOPERATION OF THE

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

AND THE

FLORIDA NATIONAL GUARD

DECEMBER, 1977

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO. PB286272
4. TITLE AND SUBTITLE Report on Lawne Lake, Orange County, Florida		5. REPORT DATE Prepared December 1977 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO. Working Paper # 262
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pacific Northwest Environmental Research Laboratory U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO. 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Final - March 1973 - Feb. 1974 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading	National Eutrophication Survey Lake Survey	05B 05C

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release Unlimited	Unclassified	44
	20. SECURITY CLASS *(This page)*	22. PRICE A03-A01

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Florida Department of Environmental Regulation for professional involvement and to the Florida National Guard for conducting the tributary sampling phase of the Survey.

Joseph W. Landers, Jr., Secretary of the Department of Environmental Regulation; John A Redmond, former Director of the Division of Planning, Technical Assistance, and Grants; and Dr. Tim S. Stuart, Chief of the Bureau of Water Quality, provided invaluable lake documentation and counsel during the survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

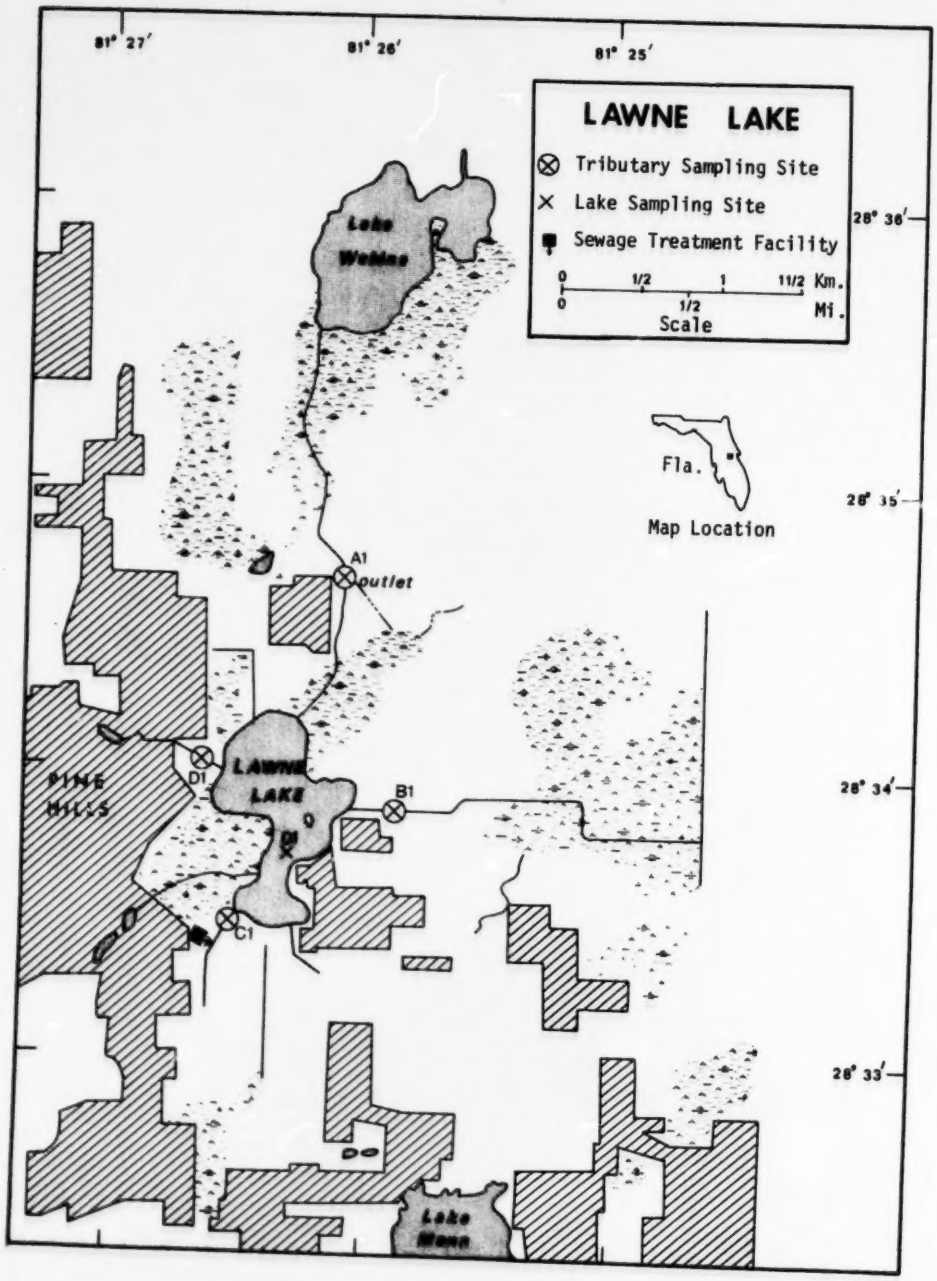
Major General Henry W. McMillan (Retired), then the Adjutant General of Florida, and Project Officer Colonel Hugo F. Windham, who directed the volunteer efforts of the Florida National Guard, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF FLORIDA

LAKE NAME	COUNTY
Alligator	Columbia
Apopka	Lake, Orange
Banana	Polk
Crescent	Flagler, Putnam
Doctors	Clay
Dora	Lake
East Tohopekaliga	Osceola
Effie	Polk
Eloise	Polk
George	Putnam, Volusia
Gibson	Polk
Glenada	Highlands
Griffin	Lake
Haines	Polk
Hancock	Polk
Horseshoe	Seminole
Howell	Orange, Seminole
Istokpoga	Highlands
Jessie	Polk
Jessup	Seminole
Kissimmee	Osceola
Lawne	Orange
Lulu	Polk
Marion	Polk
Minnehaha	Orange
Minneola	Lake
Monroe	Seminole, Volusia
Munson	Leon
Okeechobee	Glades, Hendry, Martin, Okeechobee, Palm Beach
Poinsett	Brevard, Orange, Osceola
Reedy	Polk
Seminole	Jackson, FL; Decatur, Seminole, GA
Seminole	Pinellas
South	Brevard
Talquin	Gadsden, Leon
Tarpon	Pinellas
Thonotosassa	Hillsborough
Tohopekaliga	Osceola
Trout	Lake
Weohyakapka	Polk
Yale	Lake


81° 27′
81° 26′
81° 25′
28° 36′
28° 35′
28° 34′
28° 33′
LAWNE LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0 1/2 1 1 1/2 Km.
0 1/2 Mi.
Scale
Fla.
Map Location
Lake Weldna
A1
outlet
D1
LAWNE LAKE
B1
C1
PINE HILLS
Lake Mona

LAWNE LAKE

STORET NO. 1249

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lawne Lake is highly eutrophic. It ranked thirty-eighth when the 41 Florida lakes sampled in 1973 were compared using a combination of six parameters*. All of the other lakes had less median total phosphorus, 26 had less median dissolved phosphorus, all the rest had less median inorganic nitrogen and greater mean Secchi disc transparency, and 32 had less mean chlorophyll a.

Dredging operations were in progress during the year of sampling resulting in changes in the water quality as shown by the decrease in Secchi disc transparency, chlorophyll a levels, and phytoplankton counts (see data summary, page 6). High concentrations of sediments were noted in the September and November phytoplankton samples indicating very high turbidity that most likely suppressed primary productivity.

An alum treatment after dredging reduced the turbidity from about 600 Jackson turbidity units (JTU) to less than 70 JTU, and the Secchi disc transparency increased significantly (Gabor, 1975).

B. Rate-Limiting Nutrient:

Algal assay results indicate that primary productivity in Lawne

* See Appendix A.

Lake was limited by nitrogen at the time the sample was collected (03/14/73). The lake data indicate phosphorus was the limiting nutrient at the other two sampling times; however, as noted above, primary productivity probably was light-limited at those times.

C. Nutrient Controllability:

1. Point sources--At this time, no known wastewater treatment plants impact Lawne Lake. As of November, 1973, sewage formerly treated at the Lawne Lake Shores wastewater treatment plant was diverted to the City of Orlando treatment facilities. An estimated 4.3% of the total phosphorus and 5.1% of the total nitrogen inputs were contributed by the Lawne Lake Shores plant during six months of discharge in the Survey sampling year.

The sampling year phosphorus loading of 15.02 g/m^2/year is over 23 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading. On the basis of Survey data, it is calculated that diversion of the Lawne Lake Shores effluent reduced the loading to 14.37 $g/m^2/yr$; and even though the eutrophic level for Florida lakes may be higher than that suggested by Vollenweider (see page 14), it does not seem likely that the effluent diversion will result in a significant improvement in the condition of the lake.

2. Non-point sources--It is estimated that the gaged tributaries contributed over 68% of the phosphorus and nearly 59% of the nitrogen reaching the lake during the sampling year.

The phosphorus export rate of Canal B-1 was an exceptionally

high 1,052 kg/km^2 during the sampling year (page 13) and may have been the result of urban runoff. The 1970 U.S.G.S. Orlando West quadrangle map indicates the canal drains predominantly urban areas.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††.

1. Surface area: 0.63 kilometers^2.
2. Mean depth: 1.1 meters.
3. Maximum depth: 1.8 meters.
4. Volume: 0.693 x 10^6 m^3.
5. Mean hydraulic retention time: 36 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Canal B-1	5.8	0.12
Canal C-1	0.3	0.01
Canal D-1	0.4	0.02
Minor tributaries & immediate drainage -	3.6	0.07
Totals	10.1	0.22**

2. Outlet -

Canal A-1	10.7***	0.22

C. Precipitation****:

1. Year of sampling: 123.5 centimeters.
2. Mean annual: 130.5 centimeters.

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† Table of metric equivalents--Appendix B.
†† Anonymous, 1972.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1975".
** Sum of inflows adjusted to equal outflow.
*** Includes area of lake.
**** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Lawne Lake was sampled three times during 1973 by means of a pontoon-equipped Huey helicopter. Each time, a near-surface sample for physical and chemical parameters was collected from one station on the lake (see map, page v). During each visit, a single depth-integrated (near bottom to surface) sample was collected for phytoplankton identification and enumeration; and a similar sample was collected for chlorophyll a analysis. During the first visit, a single 18.9-liter depth-integrated sample was taken for algal assays. Only near-surface samples were taken.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE LAWNE
STORET CODE 1249

PARAMETER	1ST SAMPLING (3/14/73) 1 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (9/ 5/73) 1 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (11/ 7/73) 1 SITES RANGE	MEAN	MEDIAN
TEMP (C)	26.8 - 26.8	26.8	26.8	29.3 - 29.3	29.3	29.3	22.2 - 22.2	22.2	22.2
DISS OXY (MG/L)	****** -**********			4.6 - 4.6	4.6	4.6	6.4 - 6.4	6.4	6.4
CNDCTVY (MCROMO)	265. - 265.	265.	265.	203. - 203.	203.	203.	225. - 225.	225.	225.
PH (STAND UNITS)	9.7 - 9.7	9.7	9.7	6.8 - 6.8	6.8	6.8	7.3 - 7.3	7.3	7.3
TOT ALK (MG/L)	72. - 72.	72.	72.	32. - 32.	32.	32.	24. - 24.	24.	24.
TOT P (MG/L)	1.140 - 1.140	1.140	1.140	2.560 - 2.560	2.560	2.560	4.550 - 4.550	4.550	4.550
ORTHO P (MG/L)	0.600 - 0.600	0.600	0.600	0.044 - 0.044	0.044	0.044	0.117 - 0.117	0.117	0.117
NO2+NO3 (MG/L)	0.130 - 0.130	0.130	0.130	1.070 - 1.070	1.070	1.070	1.990 - 1.990	1.990	1.990
AMMONIA (MG/L)	0.120 - 0.120	0.120	0.120	0.280 - 0.280	0.280	0.280	0.200 - 0.200	0.200	0.200
KJEL N (MG/L)	4.400 - 4.400	4.400	4.400	3.700 - 3.700	3.700	3.700	5.100 - 5.100	5.100	5.100
INORG N (MG/L)	0.250 - 0.250	0.250	0.250	1.350 - 1.350	1.350	1.350	2.190 - 2.190	2.190	2.190
TOTAL N (MG/L)	4.530 - 4.530	4.530	4.530	4.770 - 4.770	4.770	4.770	7.090 - 7.090	7.090	7.090
CHLRPYL A (UG/L)	240.6 - 240.6	240.6	240.6	10.9 - 10.9	10.9	10.9	3.2 - 3.2	3.2	3.2
SECCHI (METERS)	0.4 - 0.4	0.4	0.4	0.0 - 0.0	0.0	0.0	0.0 - 0.0	0.0	0.0

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algae units per ml
03/14/73	1. *Kircheriella sp.*	20,000
	2. *Scenedesmus sp.*	17,143
	3. Flagellates	12,857
	4. *Raphidiopsis sp.*	10,714
	5. *Microcystis sp.*	7,500
	Other genera	29,643
	Total	97,857
09/05/73* - No cells found in sample.		
11/07/73*	1. Flagellates	713
	2. *Phacus sp.*	267
	3. *Euglena sp.*	89
	4. *Synedra sp.*	89
	Other genera	-
	Total	1,158

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/14/73	1	240.6
09/05/73	1	10.9
11/07/73	1	3.2

* The September and November phytoplankton samples had very heavy concentrations of sediments which apparently resulted in reduced numbers of phytoplankton.

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.430	0.318	18.9
0.050 P	0.480	0.318	18.6
0.050 P + 1.0 N	0.480	1.318	35.1
1.0 N	0.430	1.318	29.6

2. Filtered and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.384	0.276	26.7
0.050 P	0.434	0.276	25.2
0.050 P + 1.0 N	0.434	1.276	45.9
1.0 N	0.384	1.276	37.9

3. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Lawne Lake was very high at the time the sample was collected (03/14/73). The lack of significant change in yields with increased levels of orthophosphorus until nitrogen was also added indicates that the lake was nitrogen limited when sampled. Note that the addition of nitrogen alone produced a yield significantly greater than that of the control.

The lake data indicate phosphorus was the limiting nutrient in September and November; i.e., the mean inorganic nitrogen to

orthophosphorus ratios were 19 to 1 or greater, and phosphorus limitation would be expected. However, because of dredging and the resulting turbidity, primary productivity probably was light limited at those times.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Florida National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for December when two samples were collected. Sampling was begun in March, 1973, and was completed in February, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Florida District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings.* Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in $kg/km^2/year$, at stations B-1, C-1, and D-1 and multiplying the means by the ZZ area in km^2.

The operator of the Lawne Lake Shores wastewater treatment plant provided monthly samples and corresponding flow data for part of the sampling year. Nutrient loads shown are based on six months of discharge after which time sewage was diverted to the Orlando treatment facility.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal* -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Lawne Lake Shores**	1,360	act. sludge	29.0	Canal C-1

2. Known industrial - None

* Treatment plant questionnaire.
** Effective November, 1973, sewage was diverted to the Orlando treatment facility.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Canal B-1	6,100	64.5
Canal C-1	150	1.6
Canal D-1	225	2.4
b. Minor tributaries & immediate drainage (non-point load) -	2,540	26.8
c. Known municipal STP's -		
Lawne Lake Shores	410	4.3
d. Septic tanks* -	5	0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	30	0.3
Total	9,460	100.0

2. Outputs -

Lake outlet - Canal A-1 2,830

3. Net annual P accumulation - 6,630 kg.

* Estimate based on 10 lakeshore dwellings; see Working Paper No. 175.
** Brezonik and Shannon, 1971.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Canal B-1	18,225	51.8
Canal C-1	1,195	3.4
Canal D-1	1,245	3.5
b. Minor tributaries & immediate drainage (non-point load) -	12,285	34.9
c. Known municipal STP's -		
Lawne Lake Shores	1,805	5.1
d. Septic tanks* -	85	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	370	1.1
Total	35,210	100.0

2. Outputs -

Lake outlet - Canal A-1	16,220

3. Net annual N accumulation - 18,990 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Canal B-1	1,052***	3,142
Canal C-1	500	3,983
Canal D-1	562	3,112

* Estimate based on 10 lakeshore dwellings; see Working Paper No. 175.
** Brezonik and Shannon, 1971.
*** Unusually high export rate is indicative of urban runoff.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Note, however, that Florida lakes may be able to assimilate phosphorus at a somewhat higher level than that suggested by Vollenweider (Shannon and Brezonik, 1972).

Essentially, Vollenweider's "dangerous' loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/year	15.02	10.52	55.9	25.7

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Lawne Lake:

"Dangerous" (eutrophic loading)	0.64
"Permissible" (oligotrophic loading)	0.32

V. LITERATURE REVIEWED

Anonymous, 1972. Lawne Lake proposed restoration plan. Orange Co. Poll. Contr. Dept. and Orange Co. Eng. Dept., Orlando.

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Shannon, Earl E., and Patrick L. Brezonik, 1972. Relationships between lake trophic state and nitrogen and phosphorus loading rates. Env. Sci. & Techn. 6 (8): 719-725.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1201	ALLIGATOR LAKE	0.626	0.260	474.000	87.733	13.100	0.386
1202	LAKE APOPKA	0.102	0.230	484.176	46.611	8.200	0.019
1203	LAKE BANANA	0.660	0.260	482.667	208.600	3.600	0.293
1206	LAKE CRESCENT	0.065	0.130	473.889	10.211	10.200	0.033
1207	DOCTORS LAKE	0.084	0.120	465.555	27.100	10.600	0.028
1208	LAKE DORA	0.102	0.240	482.889	54.978	7.400	0.022
1209	LAKE EFFIE	1.480	0.410	489.000	261.433	15.000	0.950
1210	LAKE GEORGE	0.129	0.165	469.308	35.000	11.000	0.063
1211	LAKE GIBSON	0.167	0.115	470.000	19.675	10.200	0.069
1212	GLENADA LAKE	0.134	0.165	454.167	27.667	14.700	0.072
1214	LAKE GRIFFIN	0.119	0.260	481.333	66.855	6.600	0.038
1215	LAKE HAINES	0.063	0.115	462.667	26.567	10.600	0.014
1217	LAKE HANCOCK	0.772	0.195	483.500	97.900	5.600	0.158
1219	LAKE HORSESHOE	0.034	0.130	459.000	12.067	11.500	0.023
1220	LAKE HOWELL	1.260	0.245	464.000	54.117	9.000	1.175
1221	LAKE ISTOKPOGA	0.039	0.120	464.222	6.594	8.600	0.010
1223	LAKE JESSUP	0.492	0.290	487.000	76.550	7.600	0.288
1224	LAKE KISSIMMEE	0.034	0.145	463.667	24.142	8.800	0.007
1227	LAKE LULU	1.490	1.065	483.000	276.566	14.300	1.030
1228	LAKE MARION	0.044	0.260	468.833	29.967	7.600	0.016
1229	LAKE MINNEHAHA	0.038	0.060	435.000	8.733	7.700	0.012
1230	LAKE MINNEOLA	0.018	0.070	406.333	3.333	7.400	0.009
1231	LAKE MONROE	0.188	0.300	474.555	14.225	10.800	0.128
1232	LAKE OKEECHOBEE	0.063	0.185	472.366	14.524	9.800	0.010
1234	LAKE POINSETT	0.085	0.150	469.000	6.500	10.600	0.051
1236	LAKE PEEDY	0.033	0.330	468.500	34.837	10.600	0.008
1238	LAKE SOUTH	0.074	0.130	464.000	23.167	9.000	0.028
1239	LAKE TALQUIN	0.085	0.290	462.167	9.483	14.400	0.031

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1240	LAKE THONOTOSASSA	0.645	0.095	466.167	37.700	10.200	0.565
1241	LAKE TOHOPEKALIGA	0.246	0.280	472.917	38.633	10.500	0.152
1242	TROUT LAKE	1.110	0.650	472.000	76.967	12.900	0.970
1243	LAKE WEOHYAKAPKA	0.047	0.080	458.667	7.767	8.200	0.011
1246	LAKE YALE	0.027	0.160	441.000	25.367	7.600	0.014
1247	LAKE MUNSON	1.475	0.925	486.667	149.317	12.200	0.852
1248	LAKE SEMINOLE	0.234	0.175	473.833	102.800	8.600	0.026
1249	LAKE LAWNE	2.560	1.350	494.667	84.900	10.400	0.117
1250	LAKE TARPON	0.041	0.070	480.889	6.867	9.000	0.027
1252	LAKE ELOISE	0.486	0.170	465.333	70.233	12.200	0.339
1256	LAKE JESSIE	0.051	0.090	452.667	26.300	10.800	0.011
1261	EAST LAKE TOHOPEKALIGA	0.042	0.070	440.833	5.167	9.400	0.007
1264	PAYNE'S PRAIRIE LAKE (NO	1.260	0.140	476.000	98.200	7.400	1.210

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1201	ALLIGATOR LAKE	25 (10)	29 (10)	30 (12)	18 (7)	10 (4)	18 (7)	130
1202	LAKE APOPKA	50 (20)	38 (15)	10 (4)	38 (15)	74 (29)	70 (28)	280
1203	LAKE BANANA	23 (9)	29 (10)	20 (8)	5 (2)	100 (40)	23 (9)	200
1206	LAKE CRESCENT	65 (26)	70 (27)	33 (13)	80 (32)	48 (18)	50 (20)	346
1207	DOCTORS LAKE	60 (24)	76 (30)	60 (24)	55 (22)	34 (12)	56 (22)	341
1208	LAKE DORA	53 (21)	35 (14)	18 (7)	33 (13)	90 (35)	68 (27)	297
1209	LAKE EFFIE	5 (2)	10 (4)	3 (1)	3 (1)	0 (0)	10 (4)	31
1210	LAKE GEORGE	45 (18)	54 (21)	48 (19)	43 (17)	23 (9)	43 (17)	256
1211	LAKE GIBSON	40 (16)	81 (32)	45 (18)	70 (28)	48 (18)	40 (16)	324
1212	GLENADA LAKE	43 (17)	54 (21)	85 (34)	53 (21)	3 (1)	38 (15)	276
1214	LAKE GRIFFIN	48 (19)	29 (10)	23 (9)	30 (12)	95 (38)	48 (19)	273
1215	LAKE HAINES	70 (28)	81 (32)	75 (30)	58 (23)	34 (12)	78 (31)	396
1217	LAKE HANCOCK	18 (7)	43 (17)	13 (5)	13 (5)	98 (39)	28 (11)	213
1219	LAKE HORSESHOE	93 (37)	70 (27)	80 (32)	78 (31)	20 (8)	65 (26)	406
1220	LAKE HOWELL	11 (4)	23 (9)	69 (27)	35 (14)	60 (23)	3 (1)	201
1221	LAKE ISTOKPOGA	85 (34)	76 (30)	65 (26)	93 (37)	69 (27)	89 (35)	477
1223	LAKE JESSUP	28 (11)	18 (7)	5 (2)	25 (10)	83 (32)	25 (10)	184
1224	LAKE KISSIMMEE	90 (36)	63 (25)	73 (29)	65 (26)	65 (26)	99 (39)	455
1227	LAKE LULU	3 (1)	3 (1)	15 (6)	0 (0)	8 (3)	5 (2)	34
1228	LAKE MARION	78 (31)	29 (10)	53 (21)	50 (20)	83 (32)	73 (29)	366
1229	LAKE MINNEHAHA	88 (35)	91 (36)	95 (38)	85 (34)	78 (31)	80 (32)	517
1230	LAKE MINNEOLA	100 (40)	98 (38)	98 (39)	100 (40)	90 (35)	93 (37)	579
1231	LAKE MONROE	38 (15)	15 (6)	28 (11)	75 (30)	26 (10)	33 (13)	215
1232	LAKE OKEECHOBEE	68 (27)	45 (18)	40 (16)	73 (29)	53 (21)	89 (35)	368
1234	LAKE POINSETT	58 (23)	60 (24)	50 (20)	95 (38)	34 (12)	45 (18)	342
1236	LAKE WEEDY	95 (38)	13 (5)	55 (22)	45 (18)	34 (12)	95 (38)	337
1238	LAKE SOUTH	63 (25)	70 (27)	69 (27)	68 (27)	60 (23)	56 (22)	386
1239	LAKE TALQUIN	55 (22)	20 (8)	78 (31)	83 (33)	5 (2)	53 (21)	294

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	SOC-MEAN SEC	MEAN CHLOPA	1S-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1240	LAKE THONOTOSASSA	20 (8)	85 (34)	58 (23)	40 (16)	48 (18)	15 (6)	266
1241	LAKE TOHOPEKALIGA	33 (13)	40 (16)	38 (15)	48 (19)	40 (16)	30 (12)	229
1242	TROUT LAKE	15 (6)	8 (3)	43 (17)	23 (9)	13 (5)	8 (3)	110
1243	LAKE WEOHYAKAPKA	75 (30)	91 (36)	83 (33)	88 (35)	74 (29)	84 (33)	495
1246	LAKE YALE	98 (39)	58 (23)	90 (36)	63 (25)	83 (32)	75 (30)	467
1247	LAKE MUNSON	8 (3)	5 (2)	8 (3)	8 (3)	16 (6)	13 (5)	58
1248	LAKE SEMINOLE	35 (14)	48 (19)	35 (14)	10 (4)	69 (27)	63 (25)	260
1249	LAKE LAWNE	0 (0)	0 (0)	0 (0)	20 (8)	43 (17)	35 (14)	98
1250	LAKE TARPON	83 (33)	98 (38)	100 (40)	90 (36)	60 (23)	60 (24)	491
1252	LAKE ELOISE	30 (12)	50 (20)	63 (25)	28 (11)	16 (6)	20 (8)	207
1258	LAKE JESSIE	73 (29)	88 (35)	88 (35)	60 (24)	26 (10)	84 (33)	419
1261	EAST LAKE TOHOPEKALIGA	80 (32)	98 (38)	93 (37)	98 (39)	55 (22)	99 (39)	523
1264	PAYNE'S PRAIRIE LAKE (NO	11 (4)	65 (26)	25 (10)	15 (6)	90 (35)	0 (0)	206

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	1230	LAKE MINNEOLA	579
2	1261	EAST LAKE TOHOPEKALIGA	523
3	1229	LAKE MINNEHAHA	517
4	1243	LAKE WEOHYAKAPKA	495
5	1250	LAKE TARPON	491
6	1221	LAKE ISTOKPOGA	477
7	1246	LAKE YALE	467
8	1224	LAKE KISSIMMEE	455
9	1258	LAKE JESSIE	419
10	1219	LAKE HORSESHOE	406
11	1215	LAKE HAINES	396
12	1238	LAKE SOUTH	386
13	1232	LAKE OKEECHOBEE	368
14	1228	LAKE MARION	366
15	1206	LAKE CRESCENT	346
16	1234	LAKE POINSETT	342
17	1207	DOCTORS LAKE	341
18	1236	LAKE REEDY	337
19	1211	LAKE GIBSON	324
20	1208	LAKE DORA	297
21	1239	LAKE TALQUIN	294
22	1202	LAKE APOPKA	280
23	1212	GLENADA LAKE	276
24	1214	LAKE GRIFFIN	273
25	1240	LAKE THONOTOSASSA	266
26	1248	LAKE SEMINOLE	260
27	1210	LAKE GEORGE	256
28	1241	LAKE TOHOPEKALIGA	229

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	1231	LAKE MONROE	215
30	1217	LAKE HANCOCK	213
31	1252	LAKE ELOISE	207
32	1264	PAYNE'S PRAIRIE LAKE (NO	206
33	1220	LAKE HOWELL	201
34	1203	LAKE BANANA	200
35	1223	LAKE JESSUP	184
36	1201	ALLIGATOR LAKE	130
37	1242	TROUT LAKE	110
38	1249	LAKE LAWNE	98
39	1247	LAKE MUNSON	58
40	1227	LAKE LULU	34
41	1209	LAKE EFFIE	31

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 - cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR FLORIDA 8/25/75

LAKE CODE 1249 LAWNE LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 10.7

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1249A1	10.7	0.17	0.20	0.31	0.23	0.10	0.09	0.18	0.28	0.40	0.31	0.20	0.15	0.22
1249B1	5.8	0.09	0.11	0.17	0.12	0.05	0.05	0.10	0.16	0.22	0.17	0.11	0.08	0.12
1249C1	0.3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
1249D1	0.4	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02
1249ZZ	3.5	0.05	0.06	0.09	0.07	0.02	0.02	0.05	0.08	0.12	0.09	0.06	0.04	0.06

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 10.7
SUM OF SUB-DRAINAGE AREAS = 10.0

TOTAL FLOW IN = 2.61
TOTAL FLOW OUT = 2.63

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1249A1	3	73	0.14	18	0.11				
	4	73	0.18	7	0.26				
	5	73	0.05	13	0.05				
	6	73	0.08	17	0.05				
	7	73	0.07	7	0.07				
	8	73	0.13	5	0.17				
	9	73	0.19	8	0.12				
	10	73	0.16						
	11	73	0.06	3	0.07				
	12	73	0.09	8	0.06	15	0.07		
	1	74	0.09	12	0.11				
	2	74	0.06	2	0.05				
1249B1	3	73	0.08	18	0.06				
	4	73	0.10	7	0.14				
	5	73	0.03	13	0.03				
	6	73	0.04	17	0.02				
	7	73	0.04	7	0.03				
	8	73	0.07	5	0.09				
	9	73	0.10	8	0.07				
	10	73	0.09						
	11	73	0.03	3	0.03				
	12	73	0.05	8	0.03	15	0.03		
	1	74	0.05	12	0.06				
	2	74	0.03	2	0.03				

TRIBUTARY FLOW INFORMATION FOR FLORIDA 8/25/75

LAKE CODE 1249 LAWNE LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1249C1	3	73	0.01	18	0.01				
	4	73	0.01	7	0.01				
	5	73	0.01	13	0.01				
	6	73	0.01	17	0.01				
	7	73	0.01	7	0.01				
	8	73	0.01	5	0.01				
	9	73	0.01	8	0.01				
	10	73	0.01						
	11	73	0.01	3	0.01				
	12	73	0.01	8	0.01	15	0.01		
	1	74	0.01	12	0.01				
	2	74	0.01	2	0.01				
1249D1	3	73	0.02	18	0.02				
	4	73	0.02	7	0.03				
	5	73	0.02	13	0.02				
	6	73	0.02	17	0.02				
	7	73	0.02	7	0.02				
	8	73	0.02	5	0.02				
	9	73	0.02	8	0.02				
	10	73	0.02						
	11	73	0.02	3	0.02				
	12	73	0.02	8	0.02	15	0.02		
	1	74	0.02	12	0.02				
	2	74	0.02	2	0.02				
1249ZZ	3	73	0.04	18	0.02				
	4	73	0.05	7	0.08				
	5	73	0.00	13	0.00				
	6	73	0.01	17	0.0				
	7	73	0.01	7	0.01				
	8	73	0.03	5	0.05				
	9	73	0.05	8	0.03				
	10	73	0.04						
	11	73	0.01	3	0.01				
	12	73	0.01	8	0.01	15	0.01		
	1	74	0.02	12	0.02				
	2	74	0.01	2	0.00				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/08/25

124901
28 33 47.0 081 26 13.0
LAKE LAWNE
12095 FLORIDA

11EPALES
3

2111202
0004 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/14	15 30	0000	26.8		15	265	9.70	72	0.120	4.400	0.130	0.600
73/09/05	15 20	0000	29.3	4.6	1	203	6.80	32	0.280	3.700	1.070	0.044
73/11/07	15 05	0000	22.2	6.4	0	225	7.30	24	0.200	5.100	1.990	0.117

29

STORET RETRIEVAL DATE 75/08/25

124901
28 33 47.0 081 26 13.0
LAKE LAWNE
12095 FLORIDA

11EPALES 2111202
3 0004 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/14	15 30	0000	1.140	240.6
73/09/05	15 20	0000	2.560	10.9
73/11/07	15 05	0000	4.550	3.2

APPENDIX E

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/08/25

1249A1
28 34 30.0 081 26 00.0
UNNAMED CREEK
12103 7.5 ORLANDO WEST
O/LAWNE LAKE
ST HWY 438 BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/18	09 05		0.034	4.050	0.086	0.500	1.200
73/04/07	10 10		0.058	1.470	0.140	0.120	0.375
73/05/13	09 20		0.066	1.760	0.160	0.154	0.377
73/06/17	09 30		0.023	1.400	0.096	0.132	0.290
73/07/07	09 45		0.315	4.100	0.210	0.130	1.000
73/08/05	09 45		0.120	1.900	0.240	0.056	0.090
73/09/08	15 05		0.010K	2.940	0.040	0.019	0.045
73/11/03	14 20		0.230	1.450	0.220	0.048	0.290
73/12/08	11 30		0.028	1.000	0.042	0.020	0.050
73/12/15	12 00		0.024	2.500	0.072	0.028	0.083
74/01/12	10 45		0.088	2.000	0.116	0.075	0.532
74/02/02	11 14		0.240	1.800	0.113	0.020	0.490

STORET RETRIEVAL DATE 75/08/25

124981
28 34 00.0 081 26 00.0
UNNAMED STREAM
12 7.5 ORLANDO WEST
I/LAWNE LAKE
BRDG .25 MI E OF LAWN LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/18	08 55		0.016	7.100	4.800	1.600	1.800
73/04/07	09 55		0.016	5.000	2.600	0.730	0.840
73/05/13	09 15		0.015	2.720	1.000	1.050	1.350
73/06/17	09 23		0.010K	3.200	1.470	1.260	1.300
73/07/07	09 35		0.034	5.500	2.400	0.830	0.980
73/08/05	09 25		0.026	1.890	0.310	0.063	0.150
73/09/08	15 15		0.012	2.100	0.150	0.147	0.200
73/11/03	14 15		0.021	8.050	1.700	0.330	3.670
73/12/08	10 30		0.048	6.000	3.800	1.580	2.000
73/12/15	11 30		0.076	5.500	4.100	1.700	1.880
74/01/12	10 35		0.704	4.600	0.241	0.379	2.200
74/02/02	11 08		0.560	3.100	0.740	0.800	2.500

STORET RETRIEVAL DATE 75/08/25

1249C1
28 33 30.0 081 26 30.0
UNNAMED CREEK
12 7.5 ORLANDO WEST
T/LAWNE LAKE
DIRT RD BRDG DOWNSTREAM OF PINE HILL STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/18	08 35		1.160	1.980	0.720	0.078	0.168
73/04/07	09 15		0.990	2.400	0.730	0.240	0.460
73/05/13	09 04		0.074	1.800	0.210	0.099	0.440
73/06/17	09 10		0.060	1.540	0.250	0.300	1.200
73/07/07	09 30		0.014	7.350	0.730	0.063	0.330
73/08/05	09 40		7.400	3.150	0.930	0.850	0.920
73/09/08	14 50		0.058	3.800	0.058	0.033	0.180
73/11/03	14 05		0.340	0.750	0.056	0.044	0.050
73/12/08	09 30		0.760	1.200	0.088	0.208	0.490
73/12/15	13 00		0.756	1.100	0.176	0.232	0.440
74/01/12	10 25		0.368	0.500	0.016	0.024	0.090
74/02/02	11 00		0.036	0.500	0.045	0.025	0.065

STORET RETRIEVAL DATE 75/08/25

124901
28 34 00.0 081 26 30.0
UNNAMED CREEK
12 7.5 ORLANDO WEST
T/LAWN LAKE
BANK FROM ONE OF THE RDS W OF THE LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/18	09	20	0.090	0.660	0.054	0.021	0.045
73/04/07	10	25	0.066	0.540	0.010	0.028	0.035
73/05/13	09	30	0.024	0.540	0.040	0.022	0.030
73/06/17	09	40	0.011	0.940	0.040	0.032	0.120
73/07/07	09	50	0.075	3.500	0.204	0.069	0.130
73/08/05	09	35	0.069	3.200	0.354	0.240	0.430
73/09/08	15	00	0.210	1.300	0.770	0.126	0.200
73/11/03	14	35	0.100	0.800	0.094	0.053	0.090
73/12/08	10	00	0.216	1.100	0.080	0.320	0.660
73/12/15	11	30	0.208	0.400	0.069	0.312	0.455
74/01/12	10	50	0.016	2.500	0.012	0.052	0.680
74/02/02	11	25	0.016	3.000	0.150	0.060	0.650

STORET RETRIEVAL DATE 75/08/25

12498A AS12498A P001360
28 37 20.0 081 26 20.0
LAKE LAWNE SHORES
12103 7.5 ORLANDO
T/LAWNE LAKE
UNNAMED CREEK
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/05/04	11 00		0.660	28.400	5.500	7.840	9.000	0.120	0.120
73/06/12 CP(T)- 73/06/12	08 30 16 30		3.300	15.500	3.900	2.100	2.500	0.120	0.100
73/07/09 CP(T)- 73/07/09	10 00 14 00		0.190	21.000	10.400	3.570	4.100	0.120	0.120